

THE MEMBERS MAGAZINE OF THE NATURAL
HISTORY MUSEUM OF LOS ANGELES COUNTY

Terra

VOL. 18/NO. 4



“AT MONO LAKE”

AN EXHIBITION OF DISTINGUISHED PHOTOGRAPHS ON DISPLAY
AT THE NATURAL HISTORY MUSEUM,
FROM MID-JUNE TO JULY 27th, IS A UNIQUE GATHERING OF IMAGES
BY SOME OF THE WORLD'S MOST TALENTED PHOTOGRAPHERS.

CURATORS AND COLLECTIONS

TWO GREAT EXHIBITS IN JUNE

The Malcolm Forbes family collection of toy boats is to be on display in the Alliance Changing Gallery on the Main Floor. This dazzling, adorable assemblage of boats built to "play with" spans the decades from the 1880's through the 1930's. From jaunty sailboats to gleaming tin liners and big gray battleships they're on view for the pleasure of kids from five to ninety-five.

"At Mono Lake," a great photographic exhibit including the works of eminent photographers Ansel Adams, Edward Weston, and Edward S. Curtis, opens mid-June in the Director's Gallery, Second Floor. It is discussed in an article on page 8.



Jack Alexander with model

LATE MODEL MAKER HONORED

The Museum Alliance has created a memorial fund to honor the late model maker, Jack Alexander, who died in late February. Alexander was responsible for a number of the outstanding models on display at the Museum, including a miniature suit of armor, a crossbowman, a refrigerator boxcar, and his last great work, a giant replica of the most important ship in California history, the San Salvador, one of two vessels that took Spanish explorers to San Diego for the first time. That model will be on display when the Museum's Lando Hall opens later this year. Alexander was concerned about the paucity of technical books in the Museum's library pertaining to his field. The memorial fund will purchase books on woodworking and model making.

A display of some of Alexander's models is on exhibition outside the library on the ground floor.

EARLY LIFE HISTORIES OF FISHES

Robert J. Lavenberg, Curator in the Ichthyology Section, has been awarded funds from Southern California Edison to

study fish eggs and larvae at King Harbor (Redondo Beach, California). The project is designed to determine the relative abundance of offshore fish larvae in the nearshore environment at King Harbor, and the significance of this abundance as it relates to oceanographic conditions in the Southern California Bight.

MALE CENTROLENELLA STARS

Five years ago TERRA published an issue devoted to frogs and toads. On the cover was a ventral view of a female *Centrolenella colymbiphyllum*, showing transparent belly and heart, eggs, stomach, etc. This glass frog is from one of the more interesting groups restricted to the tropical forests of Central and South America. It intrigued novelist/screen writer Charles Kaufman, who called TERRA's editor about it. She introduced him to Dr. Robert L. Bezy, Associate Curator of Herpetology at the Natural History Museum of Los Angeles County. Kaufman then wrote his first children's book, *The Frog and the Beanpole*, with Wesley, a male *Centrolenella* as hero. We are in receipt of a letter from Dorothy Briley, Editor-in-Chief, Lothrop, Lee & Shephard, which says in part:

"Thank you for providing the inspiration for this wonderful book. The Natural History Museum of Los Angeles County 'works in strange and mysterious ways, its wonders to perform.'"

The book is available at the Museum Bookshop.

AN EARLY FOURTH

Four intrepid earth scientists from the Museum enjoyed the 4th of July a little early. In early April, Drs. David Whistler, Peter Keller, Anthony Kampf, and Bruce Welton camped on the slopes of Mount St. Helens in Washington observing the fireworks from the first volcanic activity in the lower forty-eight states since Mount Lassen erupted in 1914. In addition to making scientific observations, the four staff members compiled a photographic record of the eruption and collected specimens of volcanic rock. With Mount St. Helens' cooperation, a spectacular new Museum exhibit of a volcano in action will be on display.

NEW FOSSIL LOCALITY

An important sequence of strata documenting approximately ten million years of southern California land and sea life has been discovered by Museum staff and associates in the foothills of the Santa Ana Mountains. During the past year, they have been collecting fossils from extensive exposures made during construction of a dam along Oso Creek in Orange County. At a gathering of vertebrate paleontologists from the western United



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THE NATURAL HISTORY
MUSEUM ALLIANCE
at Los Angeles County
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(Continued on page 29)

Terra Visits New Museum Director William B. [Pete] Lee and His Family



Dr. William B. (Pete) Lee, the Museum's new director.

by DOROTHY HALLE SELIGMAN

The new director of the Natural History Museum of Los Angeles County isn't new to the Museum. Dr. William B. (Pete) Lee has been around for some five-and-a-half years as the dynamic Curator and Chairman of the section of Anthropology.

Museum search committees have a natural tendency to look far afield for their directors, assuming that success somewhere else is the best criteria for leadership. They don't often stop to think of the reverse raid, where young curators who have caught the national eye by

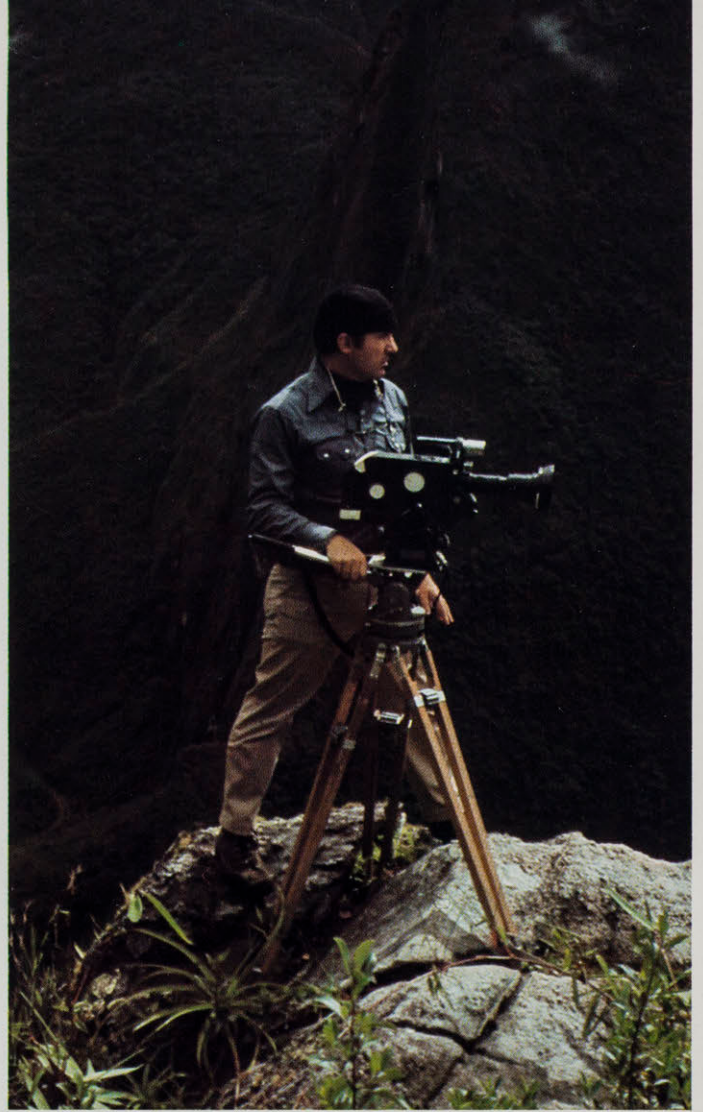
scholarship and innovation, are tapped from *their* ranks to head other museums.

As the search committee seriously began to look closer to home—(they had been combing national possibilities for more than a year since Dr. Giles Mead resigned as director)—more and more people mentioned Dr. Pete Lee.

He recently had finished making a film, *Discovering the Moche*, in cooperation with Dr. Christopher Donnan of the Museum of Cultural History at UCLA, and financed by the Samuel H. Kress

Foundation. The film won a Golden Eagle from The Council on International Non-Theatrical Events and a Red Ribbon Award at the American Film Festival. In addition to Dr. Lee's reputation as an ethnographic filmmaker, there has been much interest in his current research on the work of the classic American photographer Edward S. Curtis. The field of Visual Anthropology captivates him. He is an Adjunct Professor at USC's Center for Visual Anthropology and editor of the newsletter for the Society for the An-

Mary Lee grooms Cass with Kevin's help.
That's Burgundy in the background. Photo:
Dorothy H. Seligman



thropology of Visual Communication.

Dr. Lee, who has just turned forty, was born in Dothan, Alabama, the birthplace of both his parents. He is the third generation of William B. Lee's, and General "Light Horse Harry" Lee was a distant uncle. His father is a retired Army officer and Dr. Lee has lived all around the world. He attended the University of North Carolina as a pre-med student, and then studied Anatomy and Physiology for two years at the University of Heidelberg in Germany. It was there he met his wife, Mary, a girl born in Saskatchewan who was taking her junior year from Sacramento State U. in Germany. When Pete Lee returned to the United States he served two years in the Navy as a medical photographer and then came to the University of Southern California to obtain a BA in Anthropology. Mary Parrott was at USC then with a graduate fellowship in German. They were married and the next several years were spent with both of them in Graduate School. Along the way Pete Lee had changed his mind about medicine. He took his M A and doctorate at UCLA, while Mary Lee earned two Masters, in German and Linguistics, and a doctorate in Germanic Linguistics from

USC. Since Dr. Pete Lee has been at the Natural History Museum, Dr. Mary Lee has taught Linguistics at USC, developed the American Language Center at UCLA Extension and been, consecutively, Dean of College Development at Los Angeles Pierce College, and now Dean of Administrative Services at Los Angeles Valley College, Van Nuys.

Those are the bare background facts about the Natural History Museum's new director. In order to meet with the Museum Alliance *en masse*, via TERRA, Dr. Lee agreed to an interview at home in Chatsworth with his family.

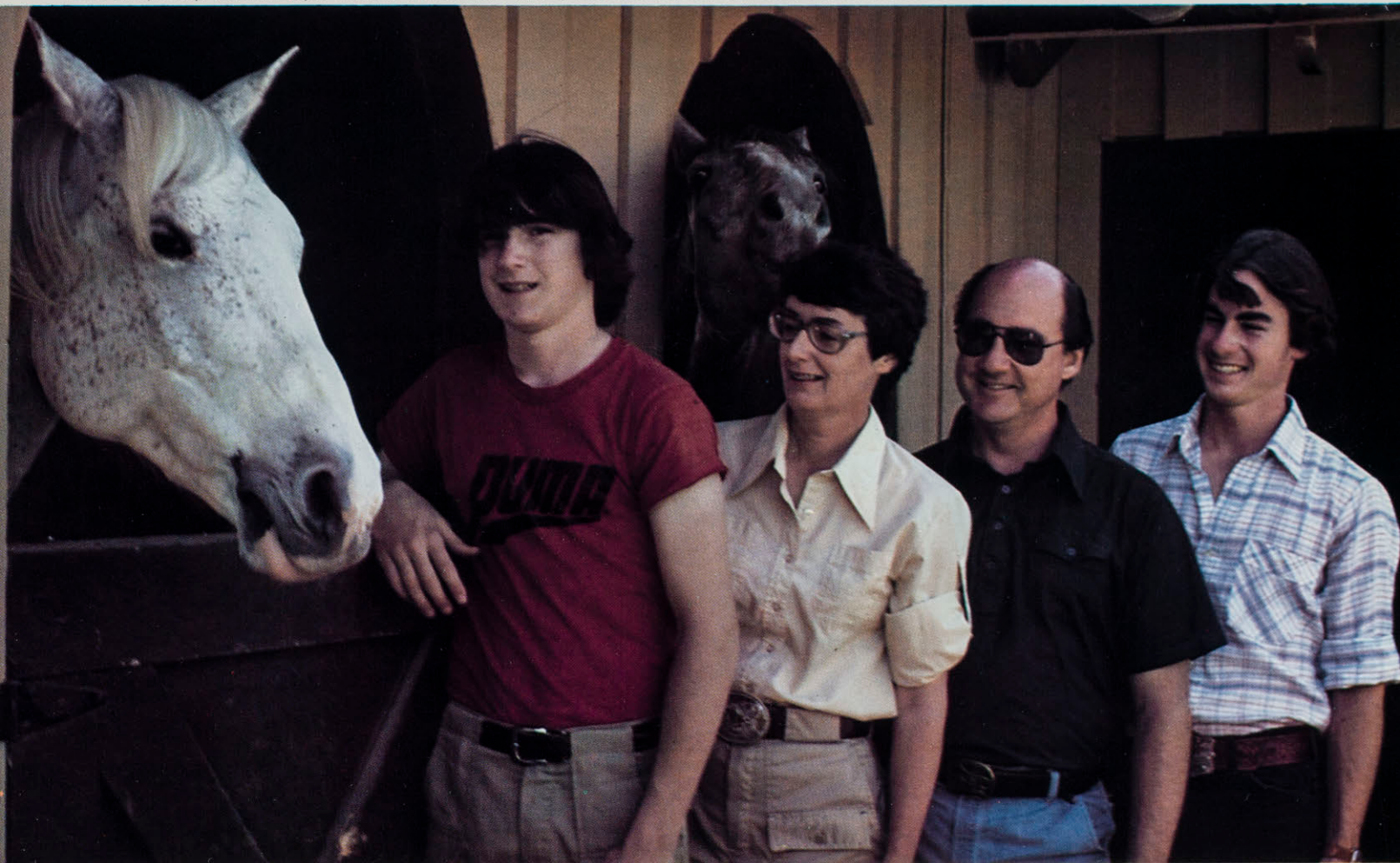
It was mid-afternoon on a Sunday and the sun was soft on the rocky Santa Susana Mountains which surmount the Lees' brick ranch house. It's horse country and as we drove up we could see riders wending their way down an adjacent hill. A gray Arabian gelding shook his white mane at us from the corral bordering the driveway, which contained a truck, a jeep and a horse trailer.

Pete and Mary Lee greeted us, along with their sons Kevin, sixteen and Chris, fourteen. Pete Lee is a stocky, round-faced man with soft brown eyes behind big

tinted glasses which change with the light. He has a heavy fringe of dark-brown hair which he makes no effort to comb over his balding head. His voice is quiet, tinged with a Southern accent. He speaks deliberately, but with enthusiasm. Mary Lee is a tall, slim, good-looking brunette. She boasts the fair skin of her English parents.

A tour of the grounds took us to see the stable and corrals, where we were introduced to Cass, a sixteen-year-old speckled gray, and Taras, the eight-year-old we'd seen while driving up. Both are registered Arabian and registered Endurance horses. Rief, four-and-a-half, is also a registered Arabian but can't start endurance racing until he's five.

Along the way we visited the tack room, and stopped at the henhouse where Mary Lee gathered two eggs. Four chickens clucked at our feet. Throughout the tour Burgundy, an Irish setter, and Sheba, a Dobie-German shepherd, tagged along. Between the house and the stables, the back patio is beautifully-patterned brick and aggregate, with a pool and jacuzzi. We settled in chairs by the pool to talk, watched by Tippy, the Lees' black-and-white cat.



QUESTION: There's been talk that you've explored other opportunities.

LEE: Mary and I are so committed to Los Angeles that it would be unreasonable to think I'd go anywhere else. This opportunity arose at the best time of my life. Los Angeles is where we want to be and the Natural History Museum is where I want to be. I thought I had the greatest job in the world as Curator of Anthropology. I'll admit that I did have a ten-year plan. Ten years down the line I wanted to be a museum director. I'm a bit ahead of schedule but it really couldn't have happened at a better time.

QUESTION: What immediate plans do you have for the Museum?

LEE: The Natural History Museum of Los Angeles County is a very important institution. It is the largest Museum west of Chicago. Throughout the world it has an extremely fine reputation in scientific circles and among other museums. Yet the people of Los Angeles know very little about its activities. I intend to change that.

QUESTION: How?

LEE: I expect to maximize our contact and commitment with the public. The public should learn what an exciting and

important scientific institution this is. We must promote the Museum in a number of ways. First, we'll put on major, blockbuster exhibits, like the pre-Columbian gold show from Colombia next year. Second, we expect to share with the public the exciting things our curators are doing all over the world. And third, we will involve the public in the activities of the Museum.

QUESTION: I agree the Museum has never gotten the recognition it deserves. Do you really think you can change that?

LEE: Absolutely. We are going to have for the first time an Office of Public Information. The Museum is going to have to relate to the public more in the 80's in order to survive. I have many ideas about how to develop a good working relationship with the media.

QUESTION: You've said you see this Museum as different from art museums or industrial museums. How?

LEE: It is different because it is a museum that is more than walls. The buildings are our at-home facilities. Our curators are in South America, Oceania, Asia, Europe, Africa and here at home working to bring back to us scientific and cultural information. I see them as a tremendous

resource to this community. We're, however, the best-kept secret in town! With all our wonderful exhibits, do you know that only one-half a percent or less of our collections are on display? The rest is held in the public trust so that the next generations will know what our time and our environment were all about.

QUESTION: How do you plan to increase alliance membership?

LEE: As the public discovers us, we are going to greatly increase our membership, and along with it, member involvement. What's encouraging is that we have the most popular subject imaginable, the natural history and cultural environment of southern California and the world. The truth is that *most* museums are still in the nineteenth century. They haven't grasped the problems of research and exhibitions we face today. We have to make ourselves competitive with the better known southern California attractions. The Raiders and the Olympics, if they both come, will provide a new focus to Exposition Park. We're actually more accessible than many other museums, being just off the Harbor freeway. Visitors don't have to fight city streets to get to us. Let's just say that I look forward to

In her spare time Mary Lee is taking courses to earn a certificate in Animal Science from Pierce College. Here she is taking "tractor driving."

Pete Lee with his pit crew truck. Note that the Smilodon logo advertises the Museum on endurance rides. Photo: Dorothy H. Seligman



working on these problems in imaginative ways.

QUESTION: Didn't you hate to give up being Curator of Anthropology?

LEE: I haven't. One of my conditions when I took the job was that I could continue as a curator. As long as I'm with the Museum I'll have a function as a curator as well. You see, the administration of the Museum is very complicated, but it isn't helped by the director's office being tucked out of the way on the Second Floor, isolated and insulated from the creative activities of the Museum. This way I move out into the Museum among the curators and collections every day.

QUESTION: What do you love about Anthropology?

LEE: Everything. Most anthropologists find it difficult to explain what they do. Margaret Mead and others have said that anthropology is mostly an attitude. In anthropology, no experience is ever wasted. I've always had a tremendous interest in many things and anthropology is the

broadest of all possible disciplines. Anthropologists dabble in everything. I'm interested in biology, cultural anthropology, history and archeology. I'm a fanatic people-watcher, I like to observe how associations develop and are formalized. I realized even before I started formal coursework that anthropology was the science that could give me the greatest possible latitude.

QUESTION: Will you still go on field trips?

LEE: Certainly. My most recent one was to British Columbia, Canada, researching the work of Edward Curtis with the Kwakiutl on Vancouver Island. I'm going to make a film on how Curtis made his 1914 film. It may even develop into a remaking of *In the Land of the Head Hunters*. Also we're going to make the first archeological excavation of a movie set. The Kwakiutl film is the first full-length documentary in film history. It pre-dates Robert Flaherty's *Nanook* by seven years. I know where Curtis made

it—the village is there but in ruins. I will ask the Kwakiutl to participate. They are anxious to do this too.

QUESTION: How does your wife feel about your becoming the director?

LEE: Let her answer that herself.

MARY LEE: One of the ways we've earned our degrees, raised two children, managed two careers and are still together is that we've supported each other in our careers. At times I'm the director's wife and at times he's the dean's husband.

LEE: Mary is an outstanding administrator. One reason is because of her rigorous training in linguistics.

MARY LEE: Linguists tend to be analytical people. You work for the best solutions with the resources you have on hand, given their limitations.

LEE: We have two careers, running parallel. Most people don't understand how we can do it. To pursue two careers you have to give up a lot of things you'd like to be doing. We've both worked hard at our jobs, at our education, and at raising



Kevin riding Cass in endurance race.

Chris canoeing off Vancouver Island. He accompanied his father last summer for Edward S. Curtis research.



our children. Only now are we making up for some of the things we didn't get to do in the past seventeen years. For one thing, Mary has always wanted to ride and own horses.

MARY LEE: I never rode as a child and always wanted to. When I finished my doctorate I started riding lessons. Then I bought an old grade horse. Having boys, they weren't interested in horse shows so we became involved in endurance riding, which is riding twenty-five, fifty, or a hundred miles in a race in one day, cross-country. That led to our owning Arabians.

LEE: Kevin is very involved in endurance riding. He was California State Junior Endurance Champion and ranked fifth nationally in 1979.

KEVIN: The toughest race I've ever been in was the 100-mile Tevis Cup last year, from Lake Tahoe to Auburn, across the Sierras, in twenty-four hours.

MARY LEE: This year both Kevin and I are going to ride the Tevis. The other big

race we're in this year is the Levi-Strauss Ride-and-Tie, with two riders and one horse. We alternate running and riding for thirty-seven miles over the San Geronimo Mountain trails.

QUESTION: Is that race why you and Kevin are taking those long morning runs every day?

MARY LEE: Right.

QUESTION: You're trying to work up to running ten miles, half of it up hill?

MARY LEE: I can go eight miles easily now. I usually do two to three miles weekday mornings before going to work, hills and sand, not flat, and six to eight mile runs on weekends. We work the horses in the evenings, often in the dark.

QUESTION: How about you and Chris, Pete? Do you ride?

LEE: We're not as keen on it as they are. But it's a great family sport and we serve as their pit crew. The horses have to stop regularly and we're there with towels, sponges, water, stethoscope and Hershey bars. We calm the horses, take the horses'

pulse and respiration. Then we call the vets over to check them. Chris has many other interests, canoeing, soccer, and scuba diving. He and I do a lot of scuba diving together. We take a dive boat from Oxnard to the Channel Islands, Santa Cruz or Anacapa, and dive for abalone, scallops, lobster.

QUESTION: Any other family sports?

LEE: I love playing tennis. Both Kevin and Chris play soccer and volleyball. Kevin plays the guitar and Mary plays the accordion. She played the pipe organ for many years. Mary keeps right on learning new things. She makes sure that I do, too.

And if it hadn't gotten dark so would have the interviewer. The range of interests of the entire Lee family is prodigious. They are themselves a fascinating study in anthropology. The Natural History Museum of Los Angeles County has come alive. Come on, Alliance members, help wake up the public to that fact.

Dorothy H. Seligman is editor of TERRA.

“AT MONO LAKE”

PHOTOGRAPHIC EXHIBIT AT THE NATURAL HISTORY MUSEUM



Many of the artists in the Museum's exhibition have helped create our rich heritage of fine photography. They include Brett Weston, Edward S. Curtis, Ansel Adams, Edward Weston, Don Worth, Al Weber, Philip Hyde, Morley Baer, Ted Orland, Timothy O'Sullivan, Edmund Teske, Donald Ross, Cole Weston, Todd Walker, Israel Russell, Stephen Johnson, and Burton Frasher, among others. The exhibition is sponsored by the National Audubon Society, Friends of the Earth Foundation, Sierra Club Foundation, the Mono Lake Committee, the Polaroid Foundation, and Western Association of Art Museums. The exhibition curator is Stephen Johnson.

by STEPHEN JOHNSON

The waters of ancient Mono Lake have splashed against its shores longer than *homo sapiens* has walked the earth. Geologists tell us the lake is certainly one million years old and may date back three million years. Visually, biologically, and geologically, this huge lake is an awesome sight. Three hundred miles north of Los Angeles on the eastern Sierra, Mono Lake is the oldest continuously existing lake in America. Mono has been chilled by an ice age, boiled by volcanoes spewing forth lava and ash, and held sacred by seven

Lenticular cloud above Mono Lake and eastern Sierra.
Photo: Philip Hyde.

NASA Landsat Satellite Infrared, August 1977, altitude > 570 miles.

hundred generations of human beings. Its waters have overflowed southward into Owens Valley and most likely spilled into Death Valley's ancient Lake Manly. Mono has become home for the largest breeding population of California Gulls in the state and provides a precious oasis of food and rest for millions of migratory birds crossing the vast, waterless expanses of the Great Basin.



“If a life-sensitive film were invented, and the Great Basin photographed from a satellite, we might see—shining like suns in the vast space of the desert—concentrations of vital energy. Among the brightest stars shining would be Mono Lake.”

—Gray Brechin





Gulls on Negit Island, Breeding Season. Photo: Galen Rowell.



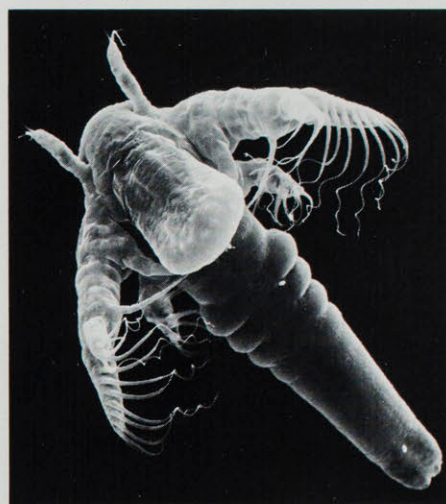
Black Point with snow. Photo: Doris Coonrad, 1979.

The exhibition, "At Mono Lake," focuses its attention on one of California's most spectacular and least known natural treasures. The sheer beauty of this ancient lake is portrayed through the eyes of many of America's major photographers. It is a rare occurrence to have artists of the stature of Ansel Adams, Edward Weston, Brett Weston, Edward S. Curtis, Timothy O'Sullivan, Philip Hyde and Don Worth in this single, unique exhibition. That we were able to gather prints from such a wide variety of photographers, is in itself a great tribute to the intriguing beauty of Mono Lake's serene landscape.

Despite the large body of fine photographs that we knew had been made at the lake, it was apparent from the outset that the exhibit would be limited in its ability to communicate the breadth of what Mono is. We knew that the air, the space, and the light of this magical place were unlikely to be captured on a piece of paper. Days were spent pouring through U.S. Geological Survey microfilm in search of an image that could symbolize the stark grandeur of Mono's setting. Circling in airless space 570 miles from earth, electronic cameras on board NASA's Landsat satellite recorded a surreal infrared composite rivaling the strangeness of walking Mono's shores. The San Joaquin Valley, Tuolumne, Yosemite, Mono, Kings Canyon, the Owens Valley, the White Mountains and the open desert of Nevada were all within sight. The Sierra slices through the image with grand Yosemite resting beside Mono's inky-blue expanse. Human constructions are splashed across the print, but barely seen. The ancient shorelines

of the lake stretch out across the Mono Basin onto the vast deserts of Nevada.

Mono Lake lies on Highway 395 below the dramatic eastern escarpment of the Sierra Nevada, just east of Yosemite National Park. This inland sea (presently sixty-two square miles) is set amidst sharply drawn volcanic cones and the towering snow-clad peaks of the high Sierra. The Mono basin's self-contained drainage system explains its improbable



Infant Brine Shrimp, one of trillions in the lake, 48 hours after hatching. Photo: Daniel Gunther. Scanning Electron Microscope.

presence among the vast space of its high desert surroundings. Its watershed extends over 700 square miles of mountains and desert. The lake has gradually become very alkaline as a result of minute quantities of salts carried by tributary streams and volcanic springs that until recently poured into the lake. Without an

outlet, the salt concentrations in the water have continued to build. Mono is presently twice as saline and ten times as alkaline (pH 9.7) as the ocean.

Providing a historical context became an early goal of the exhibition. Israel Russell's "Quaternary History of Mono Valley" and its many etchings drawn from photographs still stand as the major work on the area. The beautiful old lantern slides from Russell's original photographs became a major contribution to the exhibit. The now parched-dry Heart Lake on Paoha Island is portrayed brimming with water in an 1883 photograph by Russell. The "wonderful transparency of the dry atmosphere" emerges clearly from his images. He observed "the brilliant colors of the naked rocks... the desolate grandeur" of vast treeless vistas with Mono glowing at their focal point like "a wide sheet of burnished metal," and concluded that "no scene in nature has ever appeared... more attractive or more worthy a sacred corner in the memory than (this) bare, silent... desert." The care with which Russell explored this basin, constructed his descriptions, and exposed his photographs is singularly impressive.

Much folklore has been passed on about these unique waters of Mono Lake. The Paiute Indians are said to have believed that the strength of Mono's spirits would live as long as the sun burned and that its waters could heal a variety of diseases. Many explorers, among them Mark Twain, have extolled the water's cleansing properties. Tales of the pleasure of swimming in its soft, buoyant water are common. It is nearly impossible to sink in Mono Lake.

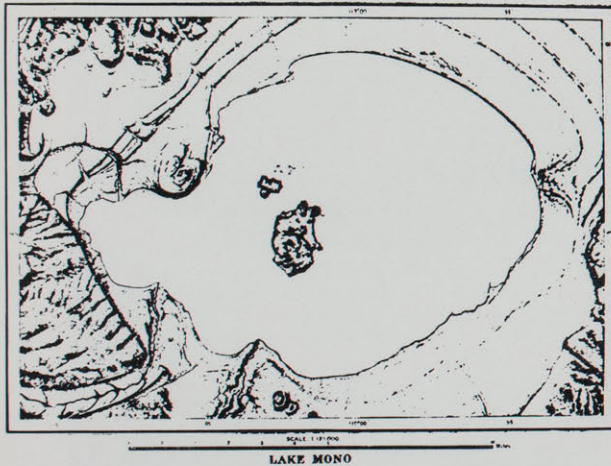


Black Point and Negit Island (circa 1930) Photo: Burton Frasher



Steam Rising off Warm Springs Cove, Paoha Island. Photo: Stephen Johnson, 1979.

Tufa Towers in Lake Mono. Photo: Israel C. Russell, 1883.



Old shorelines. Map of Lake Mono from I. C. Russell's *Quaternary History of Mono Valley, California*, 1889.



An explosive past still haunts Mono's shores. The volcanic eruption of the Mono Craters must have been an awesome experience for those living in the region and may account for some of the legends this desert sea has engendered. Many of the major geological features of the basin are volcanic creations. The Mono Craters were violent, fiery explosions taking years to form, in contrast to Black Point's enormous eruption that took place underwater in a matter of days. A powerful volcanic uplifting caused Paoha Island's white, chalky surface to rise above the water. This spectacular event was accompanied by great explosive clouds of steam whose geothermal remnants still rise from the island's Warm Springs Cove.

A tip from the Eastern California Museum in Independence led to one of our most satisfying discoveries, Burton Frasher, whose photographs from the nineteen twenties and thirties proved invaluable. Frasher's studio in Pomona, California served as his headquarters, but apparently the Mono Lake / Mammoth Lakes area was his spiritual home. Frasher was an integral part of the growing community of Mono County before World War II. He photographed annual boat races, beauty contests, the "Mark Twain Day" celebrations and the construction of the Los Angeles aqueduct. Frasher travelled on the boat tours to Mono's islands and promoted tourism by bringing in a movie crew from southern California. The mural by Frasher, with hundreds of breeding gulls on Negit Island, together with his pristine views of the lake before diversions of water and dust storms, embodied our aspirations for "At Mono Lake." These photographs evocatively portrayed the magic and mystery of this place.

Once called a "dead sea" by early explorers, Mono Lake is actually one of the most productive lakes in the world. A delicate, unique species of brine shrimp (*Artemia monica*) make Mono their home. Swimming in the lake by the trillions, the shrimp feed on enormous clouds of drifting phytoplankton. Over twenty tons of these tiny shrimp are harvested commercially every year without making a dent in their vast population. With no competition from fish, millions of birds thrive on these huge numbers of brine shrimp and balance out an ecosystem that converts more solar energy into "life-energy" than almost any place on earth.

Throughout its long history the black obsidian cone that is Negit Island has provided a home and safe breeding ground for ninety-five percent of our state's California Gulls (*Larus californicus*). At least twelve different species of birds nest at Mono and thirty-two varieties of water-

fowl have been observed taking advantage of the lake's phenomenally productive biological community. The incredible productivity of Mono Lake has made it a necessary and welcome oasis on a vast wasteland.

Surrounding the lake are strange white towers known as tufa that are actually

carbonate deposits left by fresh water springs that once bubbled under Mono's waters. These now-exposed towers stand like ceremonial monuments, silent reminders of higher water levels of the recent past.

Tufa Spires with Gulls. Photo: Stephen Johnson, 1979.



In 1940 the Los Angeles Department of Water and Power completed an extension of its Owens Valley aqueduct and began exporting water from Mono Lake's main sources of fresh water. Since that time the lake has been dropping due to unreplenished evaporation at a rate of one foot per year, and since 1970 at two feet per year. Mono Lake has now dropped over forty-three vertical feet and left 15,000 acres of former lakebed exposed. As a result, a landbridge has formed to Negit Island, providing access to coyotes and other predators who prey on nesting gulls. This intrusion has destroyed Negit's irreplaceable state-protected rookery. Where nearly 50,000 gulls once nested, in 1979 only 3,000 manage to rear their young on small islets northeast of Negit, which are also rapidly being overtaken by the growing landbridge.

The exposed lakebed has left vast expanses of alkaline dust free to be blown by the high winds in the basin and has created huge chemical dust storms. As the water recedes, its alkalinity increases, threatening the survival of the brine shrimp. As the water lowers, the weight of the lake shrinks, exerting less pressure on the ground and no longer forcing water up into the many springs that once encircled the lake. Moreover, with diverted streams and dry springs causing such drastic reductions in the amount of fresh water available, myriads of migratory birds are likely to find this one-time oasis of food and water a less welcome refuge.

This photographic exhibition provides these artists with a special opportunity for their work to have an effect on issues that deeply concern them, and also underscores the power of the photographic image. "At Mono Lake" helps make clear the unique and important role the artist can play in the understanding and preservation of our wilderness areas.

When asked to participate in the show, Philip Hyde jokingly commented, "What self-respecting photographer has not photographed at Mono Lake?" Edmund Teske's "Legend of Mono Lake" was inspired by a student whose grandfather drowned in Mono's waters. Teske refers to the lake as "mystically sacred," while Brett Weston declares himself a "Mono-maniac."

Similar feelings to Russell's eloquent impressions of one hundred years ago and our concern for the lake's future led myself, Al Weber, Don Worth and many generous photographers to assemble "At Mono Lake." While important ecological issues are involved, the exhibition is not a discussion of water rights or any other of the legal questions involved in the continuing destruction of Mono Lake. This collection is not meant to be a documentary of Mono. It is a visual state-

ment about a splendid, ancient place by artists who have a deep reverence for it.

Among the materials and processes employed in this eighty-five print collection are gelatin silver prints, albumin, gum bichromate, gravure plates, bleached/toned prints, color work, and transmitted television images. The variety of approaches contained in this show are united by one theme—the unswerving directness of this solemn, seemingly misplaced sea. The photographs range in size from 4 x 5 inch contact prints to a 27 x 60 inch mural; prints date from 1868 to 1980. Mono Lake's unique environment is viewed through aerial, underwater, satellite and microscopic images. The variety of landforms, distinct seasonal changes and abundant wildlife are particularly suited to these diverse perspectives.

These photographs currently are on a one-year California tour and in 1981 will

begin touring with the Western Association of Art Museums which will carry them throughout the United States.

A catalog from the show will be published shortly by Friends of the Earth Books. Posters, postcards and slide sets are available in the Museum bookshop. The engagement at the Natural History Museum runs through July 27th, and is located in the second floor Director's gallery.

Stephen Johnson, the exhibition's curator, has taught photography at community colleges in Arizona, New Mexico, Canada, and California. His own photographs have shown in numerous exhibitions. Currently he teaches photography at Skyline College, San Bruno, California.

Waterfall, LeeVining Creek above Mono Lake, second largest stream feeding the lake. Photo: Joe Holmes, 1979.



Butterfly Farming in the Tropics: Some Questionable Practices



Morpho peleides shortly after emerging from the chrysalis, and in the process of thermoregulating in the early morning sun at the edge of a tropical rain forest. The iridescent blue reflection of the upper sides of the wings is produced by highly modified grooved scales. The butterfly places eggs on several species of leguminous vines and trees and the adults imbibe juices from rotting fruits and moldy sap wounds in trees.

by ALLEN M. YOUNG

Visiting a tropical rain forest makes one appreciate the immense array of beauty and adaptations represented in butterflies. Many species of butterflies in tropical forests exhibit highly specialized life styles that render them vulnerable to the forces of extinction if their resources are altered. The incredible range of adaptations in tropical butterflies is reflected in the spectacular diversity of color patterns on the wings, the plants and plant products used by adults and caterpillars, and complex behavioral antics employed in courtship and avoidance of predators such as birds and reptiles. The intensity of life is high in tropical forests, including the hunting skills of the many predators of butterflies. From the large conspicuous blue *Morpho* and many richly colored Swallowtails to the subdued Owl butterflies and their near relatives, there exists a spectrum of complex interactions between butterflies, their resources, and their enemies. Such specialized ways surviving in an environment saturated with a multitude of organisms are the result of millions of years of evolutionary history.



Heliconius charitonia showing signs of being attacked by a bird. Many species of tropical butterflies are prey for birds and other animals.

A tropical rain forest contains both climax vegetation, with vertical stratification of plants and tall canopy, and many pockets of disturbed areas created by natural disasters such as tree falls. The species composition, ages, and canopy heights of plants in these habitats vary considerably. These differences in tropical habitats provide a cornucopia of evolutionary opportunities for different butterflies to specialize on specific sets of resources. Thus some species partition off the various strata of the climax forest, while others dwell in the secondary habitats. The availability of diverse food plants for caterpillars and nutritive liquid resources for adults (nectar, fruit juice, soupy fungi, etc.) plays a major role in promoting the high diversity of tropical butterflies. In turn, many microorganisms, parasites, and invertebrate and vertebrate predators depend upon the life stages of butterflies as food. Closely related species of butterflies living in the same habitat or region often utilize slightly different resources as a means of reducing competition for food and space.

Widespread habitat destruction of tropical rain forests resulting from expanding agricultural systems, industries,



A pierid butterfly, *Itaballia caesia*, visiting the flower of the forest understory plant *Gynandropsis pulcherrima*. Delicate legs permit the butterfly to balance itself while taking nectar. *Gynandropsis* is also the larval food plant of this butterfly in mountain rain forests.

and human populations is likely to have an horrendous effect on the survival of butterflies. The role, however, of other activities, such as extensive collecting and some forms of butterfly farming, in determining the dynamics of breeding and survival in tropical butterflies is less clear at this time. Although the life stages of butterflies possess a variety of adaptations ensuring survival (see "The Cause of a Caterpillar" by Julian P. Donahue in *TERRA*, Vol. 17, No. 4) these organisms are defenseless against certain kinds of large-scale collecting and butterfly farming. One form of butterfly farming recently implemented in Papua New Guinea (see Noel D. Vietmeyer's "Butterfly Ranching Is Taking Wing In Papua New Guinea" in *Smithsonian Magazine*, May 1979, and Robert M. Pyle's "How To Conserve Insects For Fun And Necessity" in *TERRA*, Vol. 17, No. 4) portrays the efforts to establish commercial butterfly farms as an alternative to outright collecting of colorful species in the bush. But in my opinion the practice raises some serious questions about the long range survival of the targeted species. The Papua New Guinea butterfly farming project is one of only a few in the tropics, and it represents only one of perhaps several alternative approaches to conserving butterfly faunas. As described below, the Papua New Guinea system is an open one, and it is by no means representative of butterfly gardens which are generally closed systems and largely independent of the surrounding environment. Owing primarily to their intrinsic beauty, the more conspicuously colored species of tropical butterflies have been intensely collected for commercial marketing all over the world.

As opposed to the "closed system" in which the rearing of butterflies and host plants is maintained completely separated from any interaction with the natural environment, the methodology of the "open system" of butterfly farming in Papua, New Guinea involves continual exchange of insects and plants between farm and nature. Gardens of food plants for caterpillars and nectar sources for adults are established and caterpillars or chrysalises of desired species are then collected in the bush and brought to the gardens for rearing. Wild butterflies from the surrounding bush are attracted to the gardens to place their eggs on plants. In either collecting the founder stock from the bush



LEFT

The caterpillar of the ithomiid *Hymenitis nero* on its food plant, a forest understory species of *Solanum*. Ithomiids are mostly specialized feeders on *Solanaceae* with each butterfly species exploiting one or two plant species as larval food plants in a forest habitat.

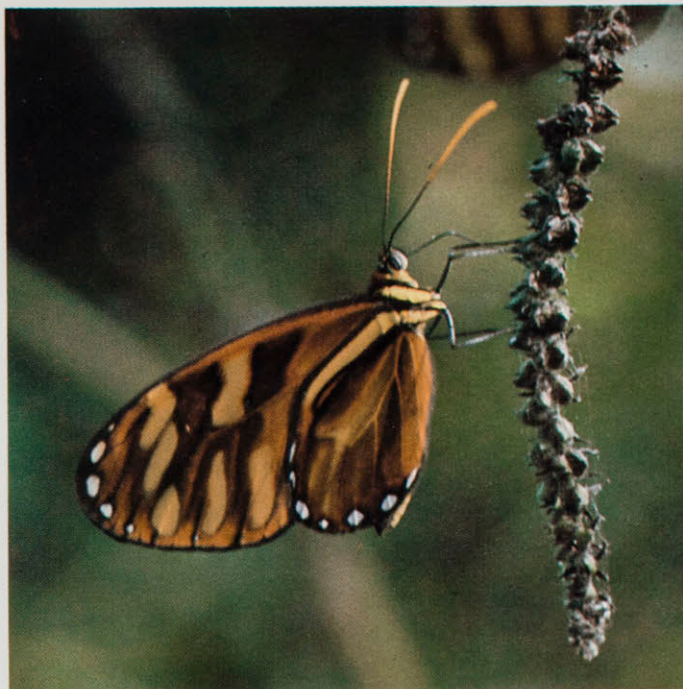
RIGHT

The caterpillar of *Morpho peleides*. The caterpillars feed on a variety of leguminous plants, often widely scattered throughout the forest habitat.

or harvesting freshly emerged adults in the gardens, only the damaged ones are left free or released; perfect specimens are kept for commercial butterfly markets. Food plants and nectar sources are obtained from the surrounding bush.

This approach is certainly an improvement over massive continuous collecting of butterflies in the surrounding tropical rain forest. Beauties such as the highly prized Birdwing Butterflies, *Ornithoptera*, are farmed in this manner. Like many other groups of tropical butterflies, species of *Ornithoptera* are specialist feeders as caterpillars on a single family of stout vines. For *Ornithoptera* and their counterparts in the American tropics, the *Aristolochia* Swallowtails (*Parides* and *Battus*), the caterpillars feed solely on *Aristolochiaceae*.

Although other population biologists may say that the effects of gene mixing between wild and cultivated populations are negligible or readjusted by natural selection, I believe that there is a real problem with the approach to butterfly farming in Papua, New Guinea because it imposes a serious form of artificial selection on populations in the bush in two ways. First, the deliberate creation of concentrated patches of food plants in gardens at settlement areas can disrupt the natural spatial arrangement of these plant species in the bush. Second, the sorting out of perfect



An ithomiid butterfly *Dircenna relata* feeding on a hanging inflorescence in a coffee plantation.

butterflies for commercial markets lowers the chances of a species surviving since damaged individuals have a lower success rate in courtship and mating. Damaged individuals also have a greater risk of being eaten. If such deleterious "stackings of the deck" in breeding populations of tropical butterflies are replicated in many gardens, I think the long-term results could be devastating for the local butterfly fauna, namely the extinction of some species. Why such a gloomy prediction?

Recent research on the natural history, behavioral ecology, and population biology of tropical butterflies has revealed highly structured patterns of resource exploitation in these insects, although we are still far away from a complete understanding of tropical butterfly faunas. The structuring of tropical communities occurs both in space and time. Each plant species possesses a particular spatial distribution, the result of a long evolutionary history of adaptation to a large spectrum of environmental pressures including seed dispersal agents, herbivores (plant parasites), pollinators, soil properties, precipitation, and ambient temperature regimes. Each plant species also adapts to other plant species in the same habitat. Much of this adaptation is reflected in the way in which the individuals of a certain plant species are spatially arranged in a particular habitat. The result is a dynamic structure and pattern in the assemblages of plant species.

A major interface of adaptation of plants to their environment is the interaction with herbivorous insects. Each plant species possesses a system of defensive chemistry, designed primarily to deter insects from feeding on it. When a particular herbivore, such as a caterpillar, penetrates this ecological barrier and successfully feeds on the plant, there is said to be a "coevolutionary race" between plant and herbivore. In this manner, herbivorous insects, especially specialized feeders, are a major pressure influencing the adaptation of plant species. The exploitation of plants by butterflies is a finely tuned coevolutionary interaction in which caterpillars overcome the chemical and structural defenses of plants, while the plants themselves evolve new counteractive defenses. Part of the strategy by which butterflies exploit plants is their ability to maintain breeding populations even when individuals of food plants are rare, i.e., have a very patchy distribution.



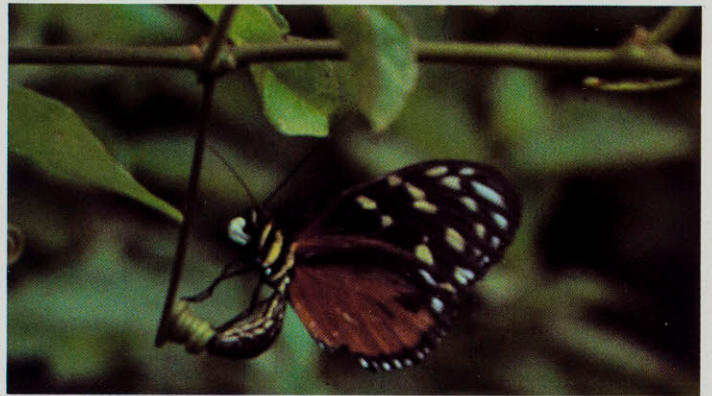
A raft of vivid yellow, spindle-shaped eggs of the rare pierid butterfly *Perrhybris lypera* placed on a young leaf of the forest understory tree *Ocotea*. The butterfly selects only the young leaves of this tree for egg placement.

Temporal patterns of variations also exist in tropical communities. Each plant species has an annual cycle of vegetative growth and reproduction superimposed upon cycles in rainfall and pollinator activity. Thus the flowers of some species are available for only a certain period each year and a lot of butterfly activity is structured around them as nectar sources. Some plants produce flowers throughout the year providing butterflies with long-term predictable resources. A large portion of the tropical butterfly fauna does not depend upon nectar as food. Many satyrids (wood nymph butterflies), brassolids (owl butterflies), morphids (morpho butterflies) and some nymphalids (brush-footed butterflies) feed upon juices of decaying fallen fruit and these butterflies are therefore dependent upon annual cycles in availability of certain kinds of fruits.

The spatial arrangement of individuals of a food plant species poses a logistical problem for a butterfly: how to locate suitable patches of the food plant for the placement of eggs. Parental care in butterflies is limited to the placement of eggs in the proper place so that caterpillars will find the appropriate food. In each species, the digestive chemistry of caterpillars is suitable to handle only certain kinds of plant tissues, and many butterflies are specialists on but a few. Examples are the dependence of several species of *Morpho* on leguminous plants, and most Ithomiines (glossy-winged butterflies) on Solanaceae. In many tropical butterflies, egg placement is very precise, not only in terms of placing the egg on the proper food plant, but also in choosing the appropriate part of the plant. Butterflies often place their eggs on new shoots resulting from periods of vegetative growth in food plant populations. Presumably the young caterpillars are not able to feed successfully on older structures. Since there can be considerable variation in the abundance of new shoots in different patches of a food plant, butterflies often invest considerable time in searching for proper egg placement sites. This form of dispersal behavior is governed by the spatial distribution of food plants and the temporal availability of new shoots and other preferred structures on individual plants. In order to properly place an egg on a leaf or new shoot of the food plant, the butterfly resembles a very agile acrobat, using both the legs and wings to achieve position and balance at the right moment. A but-



The vivid blue fruits and red floral structure of the forest understory plant *Cephaelis tomentosa*. The flowers are pollinated by certain species of hummingbirds and butterflies, and the attractive blue fruits are dispersed by birds.



Heliconius hecale placing an egg on the young tendril of a Passion Flower vine, *Passiflora vitifolia*. The large white mass of pollen adhering to the coiled proboscis of the butterfly is eventually absorbed as a source of amino acids. Several species of *Heliconius*, or Passion Vine butterflies, are specialized feeders on the pollen of certain plants in tropical forests.

terfly uses delicate sense receptors on its legs to determine if the plant is the proper one. If a leg is missing, as is often the case with damaged or handled specimens, the butterfly is deprived of its ability to successfully place the egg on the plant.

A host of other ecological factors, such as the presence of other eggs, or certain kinds of predatory insects such as ants, also influences the degree to which butterflies exhibit discriminatory behavior in egg placement, i.e., patch attractiveness varies among different patches of the food plant. All of these subtle factors interplay to produce the often specialized egg placement habits of tropical butterflies. Such precautions are necessary since the odds of an egg eventually producing a healthy adult butterfly are low in most cases. Eggs and young caterpillars are often eaten by ants, wasps, grasshoppers, and hemipteran bugs.

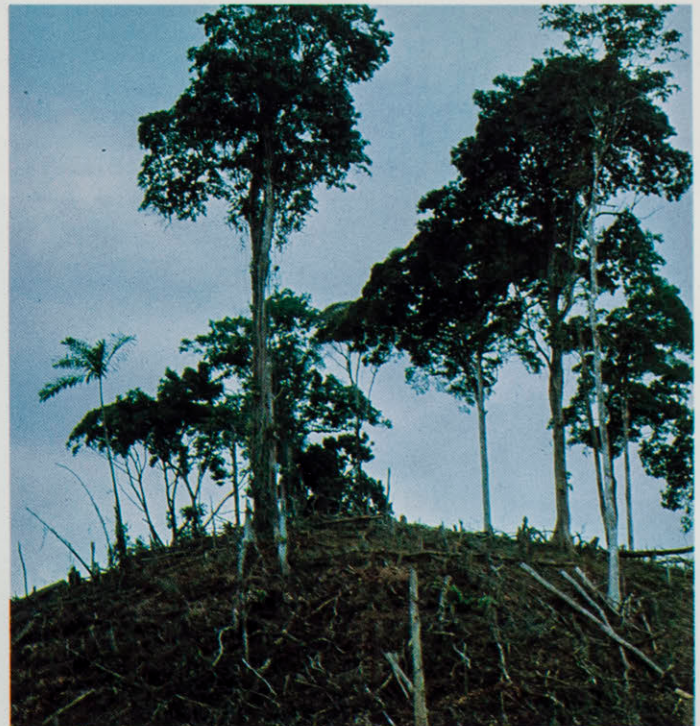
Butterfly resources such as plant tissue, nectar, pollen, and juices from fallen fruit and fungal growths together comprise a highly structured collection of ecological factors in the bush. Coupled with the omnipresent risks of being eaten, these patterns of resources result in many species of tropical butterflies having highly fragile population structures. One only has to look at the incredibly cryptic undersides of the wings of a



A brassolid butterfly *Caligo atreus*. The caterpillars are specialized feeders on certain species of palms in forest understories and the adult butterflies feed on the juices from rotting fruit. The cryptic coloration of the wings functions to conceal the butterfly from specialized visually-hunting predators.

Morpho butterfly or the vividly aposematic coloration of a *Heliconius* (Passion-vine butterflies) butterfly to appreciate the adaptations of adult butterflies to visually-hunting predators.

Specialized relationships between butterflies and plants do not end with the caterpillar; adults are often specialized to exploit only certain resources. For example, some species of *Heliconius* butterflies in American tropical forests collect pollen from the bright red flowers of the understory shrub *Cephaelis tomentosa* ("Lady's Lips") while *Parides* butterflies (Pipe-vine Swallowtails) frequently take nectar from them. Whether or not these butterflies assist in pollination of this plant is unknown, but the result of pollination is the appearance of bright blue berry-like fruits which are eventually dispersed by birds. Owing to the exploitation of a narrow range of often patchy or scarce resources and intense predation, the forces of natural selection on tropical butterflies are intense and such species are poor candidates for programs of artificial selection as exemplified by butterfly farming. Large settlement areas in the tropics represent the loss of large portions of the original forest vegetation. Replacement of some of this vegetation with specific plant species used by butterflies targeted for commercial use, and keeping the system open, represents a major disruption in the adaptive landscape of complex ecological interactions comprising tropical forest communities. The harvesting of butterflies from such a system for commercial use can only be done once the optimal yield levels are determined for each desired species. In an open system, determination of optimal yield is essential if the non-harvestable portions of the breeding populations are to survive. The optimal yield concept originated in fisheries and fish population studies in Canada in determining just how many reproductive individuals could be harvested from populations without driving the populations to extinction. In a closed system, as represented by most butterfly gardens in which there is little or no exchange of individuals with the surrounding environment, such a consideration is not important since parallel ecosystems are involved. The open system involves returning some artificially selected individuals to the bush. The return to the bush of mostly damaged butterflies places further pressure on the survival of the chosen species since these individuals would probably not mate and their genes



The large scale removal of tropical rain forests represents a major threat to the survival of tropical butterflies and many other organisms comprising these complex ecosystems.

would be eliminated from the bush populations.

The interactions of tropical butterflies with their resources represent the long-term adaptation of these insects to their environment, and solutions of conserving them must take into account the complex and often subtle components of butterfly ecology briefly touched upon here. An ideal alternative would be to set aside large forest preserves in which the total flora and fauna are protected. If this is not possible, butterfly farming should be modified to ensure the continued protection of a large percentage of food plants and other resources in the neighboring bush, with only a relatively small amount of transfer of these structured resources to the gardens. Furthermore, every effort should be made to return to the bush a complement of healthy and undamaged adults in order to minimize any effects of artificial selection. Such deliberate replenishing of the bush populations should be done at frequent intervals throughout the year. Far too little is known about the genetic structure of insect populations in the tropics to make any assumptions about the same genes (alleles) being present in most individuals of a particular species.

Dr. Allen M. Young is Curator and Head, Invertebrate Division, Milwaukee Public Museum.

A GEM'S EYE VIEW OF SOUTH AMERICA

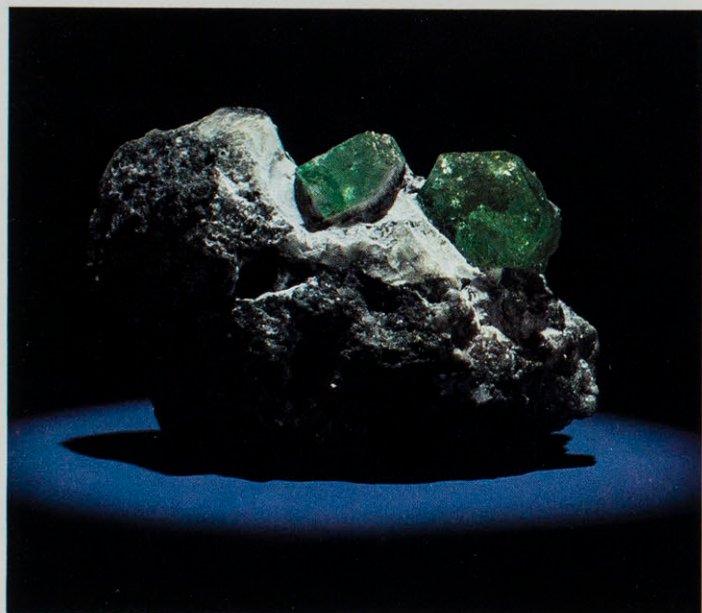
by PETER C. KELLER

Most of us are aware of the inherent beauty and great monetary value associated with faceted gems. These gems have been coveted through the ages, and in some instances have shaped the destiny of entire nations; today, much is said about gems as investments. Yet most people know little about the incredible background of the gems before they appear in display cases. How are gems formed in the Earth's crust? What do they represent in terms of Earth history? In what sort of settings are gems discovered? How are the gems mined and who mines them? What sort of life do these miners lead? After the gems are mined, how do

they find their way from the mine to the gem cutter's shop to the jewelry store window? These are some of the questions that form the background for a twenty-eight-minute documentary recently produced by the Natural History Museum of Los Angeles County and the Gemological Institute of America (GIA). To the best of our knowledge, no such film dealing with the genesis of gems has been made before.

The goal of the film was simple: to "turn on" the public, particularly young people, to the incredible story behind gems and specifically gems from the Americas. The story must be told in an entertaining manner, must educate without being too pedantic. This documentary adds proof to the point that education can be fun and entertaining.

After choosing Jeff Myrow as writer-producer-director and spending almost a



The finest emeralds in the world come from the Muzo mine, 100 km north of Bogota, Colombia. This 6 cm.-high specimen exhibits two large emerald crystals in the typical black shale and white calcite matrix. Photo: Larry Reynolds



Our film crew consisting of Lee Orloff, Jeff Myrow, and Jeri Sopanon filming the sorting of topaz crystals at the Capao mine, near Ouro Preto, Minas Gerais, Brazil.



High pressure water cannon washing the clay for imperial topaz at the Capao Mine, near Ouro Preto, Minas Gerais, Brazil.

year in conceptual planning with Dr. Vince Manson of the Gemological Institute of America, getting foreign permissions and permits to shoot, and developing contacts in South America in order to get to the mines, we organized a five-week expedition to the gem-producing areas of Brazil and Colombia for the summer of 1979. The expedition was set up in two parts: The first two weeks involved reconnaissance of potential filming sites by Alex Deutsch, Giles Mead, and myself. At the end of the two-week reconnaissance trip, Deutsch and Mead flew home and I met Vince Manson of the GIA, Jeff Myrow, and our New York based cameraman, Jeri Sopanon, and sound man, Lee Orloff in Belo Horizonte, Brazil.

The expedition was successful beyond all expectations. Not only were we able to

capture the intricacies and excitement of gem mining in a manner never before revealed to the public, but we also developed contacts and friendships in these mining localities that will be invaluable for future work in the areas.

The purposes of this article are to introduce you to the film and to give you a feeling for the two major areas that we covered on the trip: the rich mining areas of Minas Gerais, Brazil, and the emerald-producing localities of Colombia.

Two of the three weeks spent filming were in the state of Minas Gerais, Brazil. Minas Gerais (which means "general mines" in English) is one of the most prolific gemstone-producing areas in the world today. With the exception of ruby and sapphire, virtually all important gem species are found in Minas Gerais. These

gems include tourmalines, beryls (aquamarine, goshenite, morganite, and emerald), topaz, garnets, chrysoberyl, and kunzite. For the most part, such gems are found almost exclusively in granitic sheet-like igneous bodies known as pegmatites and in the stream gravels derived from the weathering and erosion of these pegmatites. Minas Gerais is especially well suited for gem mining because it is primarily underlain by granitic batholiths that injected a wealth of pegmatites into the overlying metamorphic quartzites, schists, and gneisses. The moist, warm climate of the region is conducive to deep chemical weathering of the rocks, thus causing the release of the chemically resistant gemstones into the river gravels and softening the pegmatites themselves so that they can be easily worked.



A view of the colonial town of Ouro Preto, Minas Gerais, Brazil. This city is the center for the production of imperial topaz.

Our first Brazilian filming took place at the Capao imperial topaz mine at Rodrigo Silva, some ten kilometers from the historic city of Ouro Preto. Ouro Preto is itself a national monument, with only the impressive colonial architecture permitted. Ouro Preto, ("black gold" in English) was founded because of gold deposits in the region. Today, the Ouro Preto area is known for the production of the world's supply of fine, sherry-colored imperial topaz. The Capao mine was selected for our filming because it is one of the most sophisticated and successful gem mining operations in Brazil today. Approximately 900 tons of material is processed daily at the Capao mine to yield a few kilograms of topaz, of which

only a small fraction is suitable for faceting into gems. The operation, while done on a relatively large scale, is basically simple. Bulldozers scoop up the highly weathered bedrock—now rendered to a soft clay, which contains remnants of the quartz-feldspar-topaz veins—and deposit the weathered material into dump trucks. The dump trucks then deposit their load into a concrete pit where a high-pressure water cannon makes a muddy slurry out of the material. The slurry is washed down a sluice, and the lighter clays are carried off in suspension into a streambed. The "heavies," the quartz and topaz, are collected in a second pit at the bottom of the sluice. Here, in the second pit, the heavies are washed again and the topaz is then carefully sorted out by hand.

Topaz crystals are sometimes over-

looked in sorting and are dumped into the streambed below the sorting area with the debris. These crystals are sought by independent miners known in Brazil as "*garimpeiros*." These *garimpeiros* are an important source of gemstones, for there are literally thousands of them working on their own throughout the gem-producing regions of Brazil. In fact, these *garimpeiros* are generally responsible for any new discoveries of major gem deposits. The *garimpeiro* is a fascinating character in the gem story. He gets no pay, except for what he finds and sells himself. His life is primitive at best, and provides an incredible contrast with the opulent Fifth Avenue jewelry stores that sell his product. This contrast plays an important role in the film.

From Ouro Preto, the crew traveled some 325 kilometers northeast to the



A view of the pegmatite works at Cruzeiro, Minas Gerais, Brazil. The town of Cruzeiro is on the ridge in the background.

A "*Garimpeiro*" using a screen to recover imperial topaz from near Ouro Preto, Minas Gerais, Brazil.



A magnificent green elbaite tourmaline on quartz from the Cruzeiro mine, Minas Gerais, Brazil. This specimen, considered to be one of the finest of its kind, measures 40 cm. high. Photo: Erica and Harold Van Pelt

town of Governador Valadares, which lies in the Rio Doce Valley in the heart of the gem pegmatite mining region of Minas Gerais. This area is world famous for its production of fine gemstones. In easy range of Valadares are such important pegmatite mines as Itatiaia sixty kilometers to the southeast and the Cruzeiro mine seventy-five kilometers northwest of Valadares. These are two mines that we chose to film.

The road to Itatiaia is long and dusty, but it parallels the beautiful Rio Doce river for most of the trip. About sixty kilometers from Valadares we traveled through the small town of Conseheiro Pena and from Conseheiro Pena it was only about six kilometers to the João Pinto mine in the Itatiaia district. This pegmatite mine, also known as the Jonas mine, has been the focus of attention in the gem world

since April of 1978, when a huge pocket of spectacular red tourmaline was discovered. The pegmatite, a narrow sheet-like body consisting primarily of quartz, feldspar, and mica, is easily delineated and removed, leaving a narrow gash in the countryside. The deposit is worked almost entirely by hand, although some drilling and blasting are occasionally done. At the mine we had superb cooperation, and were able to film the pegmatite and the removal of a gem pocket by a miner. Typical of the pleasant surprises that characterized the trip was the beautiful feast waiting for us outside the mine at the end of our long day of filming.

The spectacular tourmaline cluster that greets the Museum visitor as he enters our new Hall of Gems and Minerals was found about ten years ago in the Cruzeiro mine, one of the most extensive

pegmatite mines in the world and the second pegmatite that we filmed. The Cruzeiro mine reached its peak during World War II, when it employed 600 to 800 miners to produce only strategic mica. Since World War II, Cruzeiro has become famous for its fine tourmaline specimens, although mining activity has decreased significantly since the war. Today the mine is owned by Jules Sauer, our host in Brazil, and part of the property is being leased to several *garimpeiros*.

The trip to Cruzeiro takes about four hours from Governador Valadares, the last one-and-one-half hours consisting of a very narrow, rough jeep road that climbs almost 1000 meters in 9 kilometers to the 1500-meter high fern-covered range of Sierra de Safira, where the village of Cruzeiro is located. The mine commands a view of the entire region for some fifty



The washing pond for the emerald workings near Itabira, Minas Gerais, Brazil. The emerald-bearing gravels are washed and sorted here.



An overview of the workings at Muzo, Colombia. The main mine debris is pushed down to the waiting *guaqueros* in the streambed where they rework the debris for emeralds.

The alluvial emerald workings, approximately 20 km from Itabira, Minas Gerais, Brazil. This new deposit has tremendous potential to be a major producer of fine emerald in the future.

to eighty kilometers in any direction. Cruzeiro was an ideal location to achieve the overview shots of the Minas Gerais mining region, as well as underground film of working *garimpeiros*. It was here that we captured the daily life of two *garimpeiros*. Filming at Cruzeiro was almost like entering a time tunnel, going back 100 years when the western United States mines were worked using only picks, shovels, wheelbarrows, and carbide lamps.

After we finished filming in Cruzeiro and Governador Valadares, we started working our way back to Rio de Janeiro. On our way back to Rio, we stopped at a new emerald deposit about twenty kilometers outside the large iron-mining center of Itabira. For many years Brazil has produced some relatively inferior emeralds in the state of Bahia. Much to

our surprise, the new find appears to be of a quality that may rival the emeralds from Colombia, generally considered to be the world's finest. The Itabira emerald deposit is alluvial. Approximately 100 *garimpeiros* who work the field dig through about ten to fifteen meters of brownish overburden until they reach the gray gem-bearing gravel. The gray gravel is then carried by wheelbarrows to a central washing pond where the gravels are screened and hand sorted for emeralds under the watchful eyes of the owners. The deposit is potentially very large, and I suspect that we will see beautiful Brazilian emeralds on the market in the near future. After documenting the new emerald find on film, we returned to Rio de Janeiro to finish our Brazilian shooting in the gem-cutting shop of Amsterdam and Sauer, S.A., and in the jewelry stores

of the Copacabana. We owe Jules Sauer and his associates a great deal of thanks for making our Brazilian filming so successful.

From Brazil we flew to Bogotá, Colombia, to document the emerald story. Much has been written about these treasured gems from high in the Colombian Andes. The stories tell of the very dangerous and violent lives led by those who seek these emeralds. The stones were first mined by the Indians before the arrival of the Spanish. It is said that they were traded as far south as Chile and as far north as Mexico. The two principal emerald deposits are Chivor, northeast of Bogotá, and Muzo, northwest of Bogotá.



A group of "guaqueros" in the streambed at Muzo, Colombia.

When the Spanish arrived in 1537, they immediately sought the source of the emeralds. They found the Chivor deposit and put the local Indians to work as slaves in the mines. The treatment was so harsh, however, that the Spaniards killed off their Indian labor force and had to abandon Chivor. Strangely enough, Chivor was then lost for over 200 years; it wasn't until the early twentieth century that the mines were rediscovered. Since then, the Chivor mines have been worked sporadically.

Our host in Colombia, Willis F. Bronkie, is a Yale-graduate mining engineer who has been in Colombia since the early 1950s. Bronkie has much to do with the modern-day success of the Chivor mines and is today considered the dean of Colombian emeralds. He first arranged for us to visit the Chivor mines, a six-hour Jeep

ride seventy-five kilometers from Bogotá. The setting is beautiful, high in the eastern cordillera of the Colombian Andes. The climate is cool and somewhat damp. The people are pleasant. Chivor, however, was somewhat disappointing for there was very little activity at the mine. The sense of excitement was missing. Muzo, the other deposit, had to be the place to film. We followed the rumors that Muzo was "where the action is."

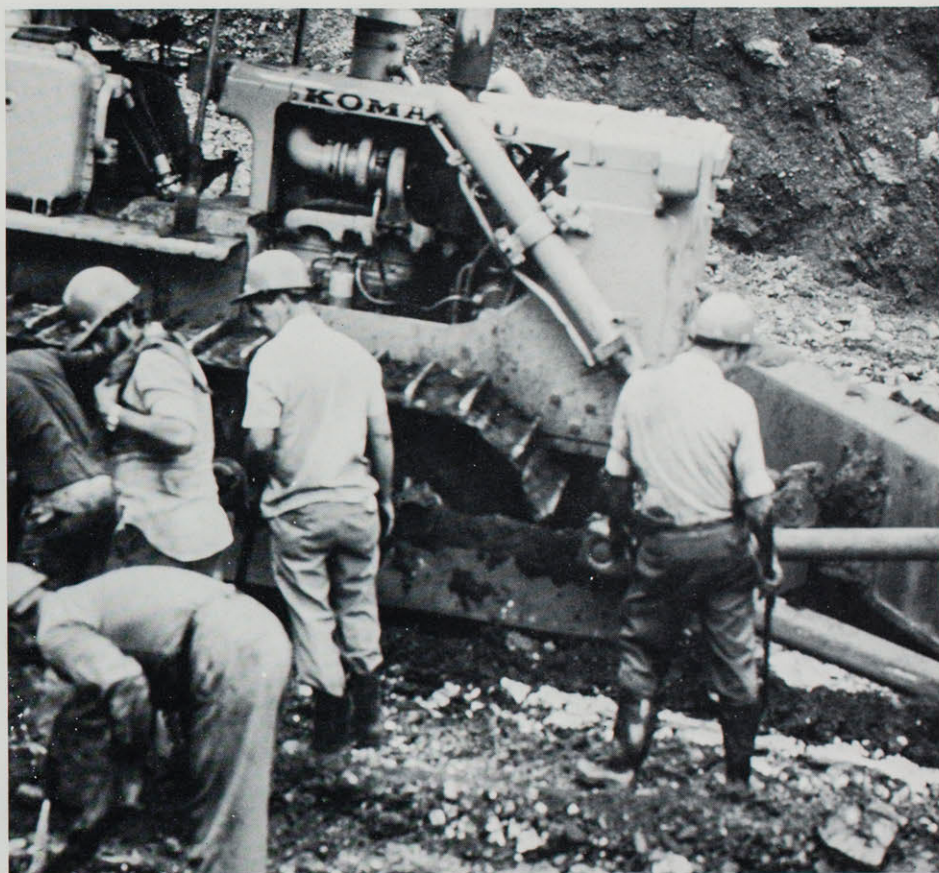
Muzo, located 100 kilometers north of Bogotá, has always had a very bad reputation. Peter Reiner, author of *Greenfire*, wrote "Chivor had been cool and invigorating. Muzo was stifling and breathless. In Chivor, the emerald formations had been yellow. In Muzo they were black, funereal." Reiner went on to point out that each working gang of miners was overseen by a squad of police with loaded

rifles. Muzo has not changed since Reiner wrote *Greenfire* in the 1940s. The mines are government owned, and there has always been a problem with "poachers." The mines were, in fact, closed in 1973 because of violence in the region that killed over 900 people. About two and a half years ago the government gave a five-year lease to a private Colombian company to operate the mines. This area is now under strict military control, although stories of violence still surface from time to time.

However, the people who are currently mining Muzo were extremely cooperative, and through Willis Bronkie they offered us the use of a helicopter to get to and from Muzo. This saved us a very dangerous six-and-a-half hours drive to the mines. The thirty-five-minute helicopter trip was spectacular, with a climax that none of us had expected. We



"Guaqueros" sorting the stream gravels for emeralds at Muzo, Colombia.



The main mine at Muzo is worked by bulldozer until the white, emerald-bearing calcite veins are exposed. Then teams of workers under armed guard are brought in to hand pick the vein.

"Garimpeiros" working the stream at mine near Itabira, Minas

followed the winding Itoco river valley and our first indication that we were approaching the mines was the presence of the famous black shale that is crisscrossed by the white calcite of the emerald-bearing veins. Then, around one more bend in the river, we looked out to see spread before us in the river bottom literally thousands of "guaqueros," or treasure hunters. They were working the river for emeralds that have washed down from the huge black emerald pit that was now in front of us. As we looked down into the riverbed we were seeing what the streams of California must have looked like during the 1850's. This was very much a gold rush atmosphere.

We landed in the main mine compound and immediately went to the mine offices where we were met by the mine administrators. Muzo was ours for the filming. We were free to go anywhere, and film anything. It was best, however, that we go with a police "guide." It wasn't long before we were on top of the main pit, looking down onto two lower levels of work-

ings, and down below into the stream with its mass of humanity. Bulldozers were being used in the open pits of the mine to expose the emerald-bearing white calcite veins. When a calcite vein was uncovered, a pick-and-shovel crew was brought in to hand dig the white calcite. The entire operation was closely watched by armed guards. When material was determined to be waste, it was then bulldozed over the side, into the stream bed, where it would be worked many times over by the thousands of independent, totally unorganized *guaqueros*. It is said that only fifty percent of the emeralds are recovered by the mining company and the rest go to the *guaqueros*. An incredible story could be filmed in the stream with the *guaqueros* alone. As I noted earlier, it's California in the 1850's. There are both men and women of virtually all ages working the stream gravels, with rarely more than a shovel, looking for that very rare emerald. As with the California gold rush, however, the people who are making money are

not the miners, but rather the great variety of vendors who sell everything from beer to shovels to a hot meal to the *guaqueros*. It is very much a society all its own. The faces of the people tell the story best.

The Colombian emerald filming was completed in Bogotá, where the selling of the emeralds by *comisionistas* was documented at the offices of Kawaii, S.A., and some of the very finest emeralds currently available in Colombia were put at our disposal in Willis Bronkie's office. With this, our South American filming was completed, and our five unique weeks in South America had passed. The film is now finished and ready for public showings. It had its premiere performance at the Natural History Museum on March 24th.

Dr. Peter C. Keller is Curator of Mineralogy / Geology at the Natural History Museum.



This imperial topaz crystal from the Ouro Preto, Minas Gerais, Brazil area is one of the largest in the world. The crystal measures 27 cm. in length. Photo: Larry Reynolds

The Chivor emerald mine, located high in the Colombia Andes, northeast of Bogotá.



States in Riverside recently, Curator Lawrence Barnes gave a well-received talk describing the work done at the site during the past year by himself and fellow Museum paleontologists Bruce J. Welton, David Spitzer, David Whistler, and Edward Wilson. Beds containing fossils of land animals alternate with beds containing marine shells and marine vertebrates such as sharks and whales, making this a potentially significant area to compare the time tables of earth history which have been established independently on the invertebrate and vertebrate fossil record.

HERBARIUM SPECIMENS COLLECTED

Christopher Davidson, Associate Curator of Botany, has been busy collecting wood samples and herbarium specimens in the families Pipieraceae (black pepper family) and Caricaceae (papaya family) in Peru. During November and December (1979) Davidson made an extensive collecting trip to central Peru, the Cordillera Azul, Cerro Carpath and in the lowlands near Iquitos. He collected over 903 species and herbarium specimens. He then spent a month at the Smithsonian identifying and sorting the collected material. Specimens will be placed in the Museum herbarium and duplicates distributed to the other major herbaria, Missouri Botanical Garden, Smithsonian Institution, New York Botanical Garden, and the Field Museum, Chicago. Davidson has an active interest in the wood anatomy of species in the Piperaceae and Caricaceae and will examine his new collections as part of an on-going study of the anatomy of these families. In May he will accompany Don Reynolds on a collecting trip to Brazil as part of the Flora Neotropica project.

ZORDICH HONORED

The Horseless Carriage Club of America has elected Jim Zordich, Associate Curator of History, as its new president.

The Club is devoted to preservation of automotive artifacts and memorabilia, with emphasis on autos and motorcycles built before 1916. These restored autos go on public tour and exhibitions are planned for Salt Lake City, Utah in June, 1980, and Portland, Oregon in July, 1980. Zordich, who is in charge of the automotive history collection at the Museum, is involved primarily with restoration. He is working currently on a steam fire engine which will be featured in the Lando Hall, a new hall of California and Southwestern history, slated to open later this year.

ELECTION DISPLAY

In this election year, the Museum is displaying its recent acquisition of the thirty-six Orth presidential portraits.



Voting booth in Museum foyer

Also on exhibit are campaign memorabilia from the mid-1800's to the 1970's, selected from the History Division's political collection.

John W. Orth was born in 1889. After achieving a reputation as a painter in the style of the old masters, he came to the United States in 1923 where his portraiture won national recognition. Orth died in Santa Ana in 1976. Museum visitors have an opportunity to cast their ballots for the 1980 presidential candidate of their choice in the main foyer. The exhibit is on display in the Changing History Gallery, main floor.

LIVING PLANTS FROM FIELD TRIP SEEDS

Sterling Keeley, Research Associate in Botany, spent December collecting in Central America. She collected in Panama, Costa Rica and Guatemala. Sterling's interest is the genus *Vernonia* in the Compositae (Sunflower) family. This genus is widespread in the tropics and its distribution is of taxonomic and biogeographical importance. Living plants have been established in the greenhouse, from seed collected on this trip and will be used in experimental hybridizations. Keeley plans another trip this June to collect more specimens. In the meanwhile she is working on pollen morphology and on hybridization experiments. This work is funded by a National Science Foundation grant to the Museum.

INTERNATIONAL COUNCIL FOR BIRD PRESERVATION

The Natural History Museum of Los Angeles County recently was elected to institutional membership in the International Council for Bird Preservation—United States Section. The group serves to:

1. Act as a forum for exchange of information between professional and

amateur ornithologists.

2. Identify and act on conservation issues.
3. Act to provide liaison between non governmental and governmental wildlife organizations relative to birds.
4. Help to ensure for quality environmental programs.

Individual members are encouraged and any and all questions relevant to the Natural History Museum of Los Angeles County or your individual involvement should be directed to the Museum delegate, Dr. Ralph W. Schreiber, Curator of Ornithology.

JAMAICA CONFERENCE

Botanists Don Reynolds and Robert Gustafson attended the Flora Neotropica conference in Kingston, Jamaica in January. In addition to seeing many of the island's distinct ecological areas, several endemic specimens were collected and added to the Museum's collections.

OLD COLLECTIONS—NEW INSIGHTS

Overhauling an old collection can lead to many pleasant surprises! Among its various other tasks, the Science Section of the George C. Page Museum is in the middle of recurating the Hancock Collection—the 700,000 to 1,000,000 La Brea bones collected by the Museum between 1913 and 1915. Since then, they have languished in the jam-packed La Brea storeroom in the basement under the dome of the rotunda, almost totally inaccessible to researchers. Now George Jefferson and volunteers are bringing them back to La Brea, washing off the grime from sixty years of neglect, repairing damage, and curating them into the new collection area in the George C. Page Museum where they readily will be available for study.

Although only partially completed, this work has already led to much new information about La Brea. Two species of mammals, the ringtail "cat" and the jaguar, have been added to the fauna from La Brea. Then George Jefferson and Bill Akersten noticed that the teeth and jaws of the La Brea bison, camel, and horse seemed to show discrete age classes. That is, there was a group of very young ones, an older group, another group still older, and so on, with few, if any, falling between these groups. Since bison is the most common of the three animals and a lot of research recently has been done on telling the age of more modern bison from wear on the teeth, Jefferson and a UCLA student, Judy Golden, began work on this species to see if there really are discrete age classes. Their preliminary results show that most bison caught at La Brea appear to be two months of age, one year



An early La Brea dig

and two months of age, and two years and two months of age. The answered question quickly led to another: What does this mean? Do these age classes result from the bison only being in the area of La Brea for part of the year or from their only getting caught in the asphalt during a part of the year or some combination of both? George and Judy are now trying to answer this second question.

In research, one thing often leads to another. While cleaning one of the bison teeth, George noticed a "wad" of chewed

plant fragments in a deep natural depression of the tooth's crown. With great excitement, he and Bill made a quick survey and found many teeth of herbivores, especially bison and camel, with similar "wads." (La Brea is one of the few places where both fossil bones and plants are well preserved.) Their excitement stemmed from the fact that the "wads" of plant material were obviously dietary samples of these extinct plant eaters, an unknown but very important aspect of their ecology. For example, it has been argued by some researchers that they became extinct because their primary foods

were reduced by climatic change at the end of the Pleistocene, but this hypothesis can not be proven or disproven without good data about their diet. Now it looks as if we will be able to determine their exact diet, at least for the ones feeding around La Brea. Janet Helms has been carefully extracting the "wads" which are sent to a specialist in identifying dietary plant fragments from living animals, Dr. Richard Hansen of Colorado State University. By the time you read this, we should have the first results.

And so it goes, just the other day we noticed....

Color Encyclopedia of Gemstones, by Joel E. Arem. Published by Van Nostrand Reinhold, 450 West 33rd Street, New York, New York, 10001. Hardcover, 8½ x 11 inches, 147 pages text, 64 pages of color photos (1977), \$35.00

This is an excellent reference book for anyone with a more than casual interest in gems. The book is unique among the many gem books available today in that it has been organized to provide rapid access to information on a particular gemstone, especially the properties that may be useful to its identification. The author has included over 200 gem or potential gem species, far more than are usually found in gem books. Furthermore, it includes and cross references obsolete or little used names for gems. This makes the book particularly useful to collectors who are interested in those stones not commonly seen in the commercial gem market. The book is obviously aimed at these collectors.

The book is generally well organized. The first twenty-seven pages are devoted to the basics of gemology, addressing such topics as "what is a gem?", the origin of gemstones, and a review of properties—color, luster, hardness, density, cleavage, optics, and spectrum—that are useful to the identification of a gem. The remainder of the book is devoted to an alphabetical listing and description of more than 200 gem species. In addition to providing a given gem's chemistry, crystallography, and properties, the author gives some insight into where and how it occurs, and, important to the collector and museum curator, where the largest known stones are housed.

The Encyclopedia is not without its problems, however. The publisher has chosen to page the color plates separate from the text, even though the plates are interspersed with the text. This can be confusing to the reader since, for example, color plate page 17 immediately follows text page 68. The index is incomplete and inconsistent. Major references to some species have been left out of the index, as have all references to color plates.

The author states in the introduction that the books' major asset is the strong array of color plates. Except for some technical difficulties in color reproduction on some of the plates, I agree. Particularly important are the excellent photos showing "rough and cut" together and photos of some of the very rare stones. The color plates are also useful in their presentation of the great variety of colors exhibited by gem species such as tourmaline and sapphire.

Peter C. Keller, Curator
Mineralogy-Geology,

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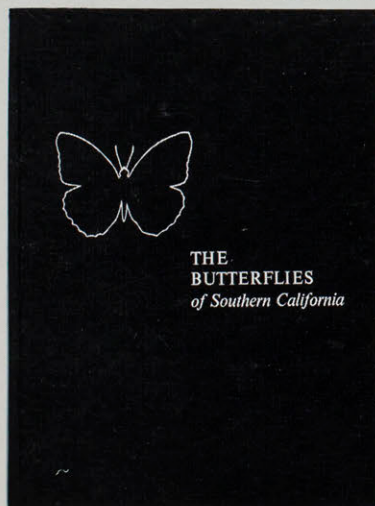
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